VIVONOETICS

VivoSense

Quick Start Guide

VivoSense Core

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Cautions and Disclaimer

VivoSense software is not a medical diagnostic tool and is intended for research and investigational purposes only. VivoSense is not intended to be, or to replace, medical advice or review by a physician.

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1. Getting Started

The quick start tutorial explains the basic elements of VivoSense and is designed to quickly familiarize a new user with the software. To maximize the value of this tutorial it is recommended that the user follow using the example file provided (see section 1.2).

For more detailed information please consult the full VivoSense user manual or contact Vivonoetics software support.

1.1. Opening VivoSense

Before using this quick start guide, please ensure that VivoSense is correctly installed on your computer with either a working trial or regular license.

Open VivoSense by double clicking on the VivoSense shortcut icon in the Vivonoetics folder on the start menu.

1.2. Opening a Sample File

The entry point for this tutorial is opening a .vsn file.

Once VivoSense is open, select the File menu and the 'Open .vsn File' option as shown in Figure 1.

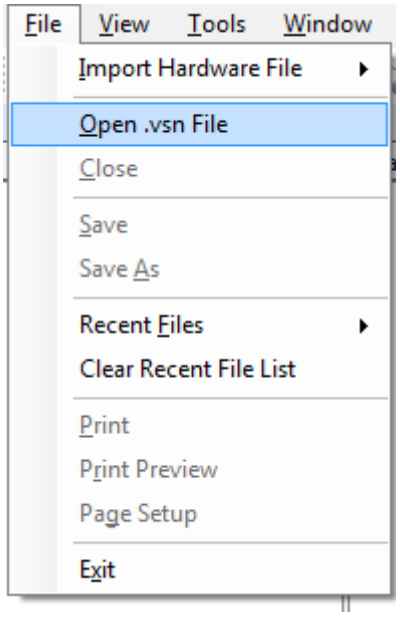

Figure 1: Opening a .vsn File

The default directory for storing .vsn files is My Documents\Vivonoetics\VivoSense\Data. If this is not the first time you are using VivoSense and you have previously changed the default directory, please navigate to this

directory and select the file ‘Quick Start Sample Session.vsn’. This file ships with the installer and should be on your PC.

1.3. Exploring VivoSense Data

VivoSense supports analysis of data collected using different physiological monitoring sensor packages/platforms. Depending on which sensor platform being used to collect data you will first need to import the raw sensor data using the Import menu option. This import creates a .vsn file which can then be saved and re-opened another time without the need for a repeated import.

This tutorial does not deal with importing raw data. In order to be generic and sensor agnostic the starting point of this tutorial is thus an already imported .vsn file and not a raw data file.

The Data Explorer

Data may be viewed using the Data Explorer. To open this, select the ‘file cabinet’ icon on the toolbar. This will display a sub-window called the data explorer. The top section of this window is shown in Figure 2.

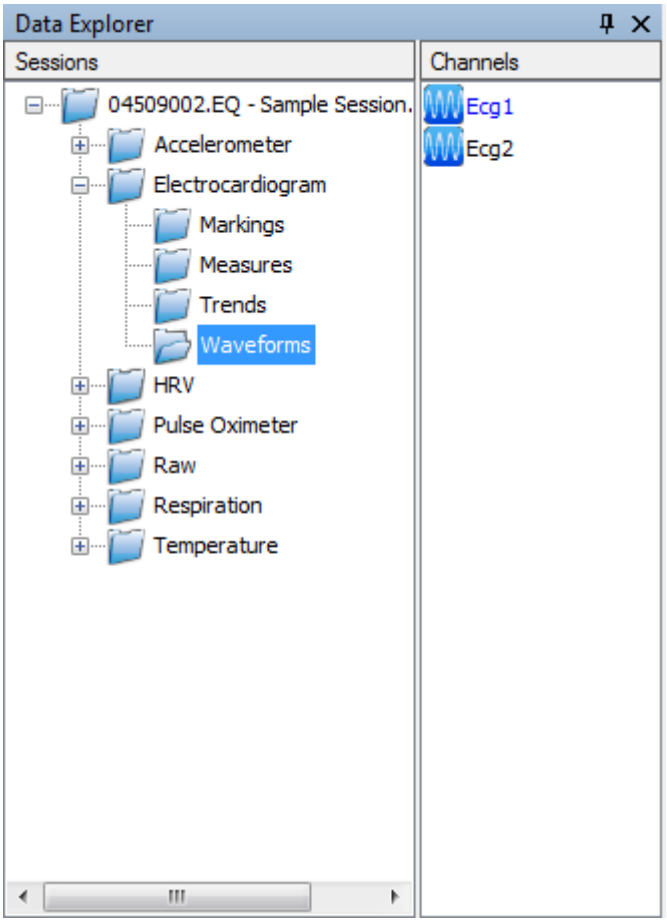

Figure 2: Data Explorer Sub-window – Top Section

Data Channels

The data explorer consists of Sessions and Channels.

A **Session** is the term used to describe a data file. Typically files are generated as a result of a recording session.

A **Channel** is the term used in VivoSense to describe available time-series data for display and analysis.

The lower half of the data explorer consists of a set of folders, with each folder containing data channels.

To begin we will expand the data folder labeled ‘Electrocardiogram’ and select the sub-folder labeled ‘Waveforms’. As may be seen from Figure 2, this folder contains two channels.

Note that different channels have different icons describing the nature of the channel. In Figure 2, the icon is used to indicate that these channels are *waveform* channels.

The Synchronized Chart Panel (SCP)

The SCP may be thought of as the drawing board upon which data is displayed. It is, as its name suggests, a placeholder for multiple charts which can contain plots of data. The ‘synchronized’ term refers to the fact that these data are all on the same time-basis and are thus synchronized in time. This is displayed in Figure 3.

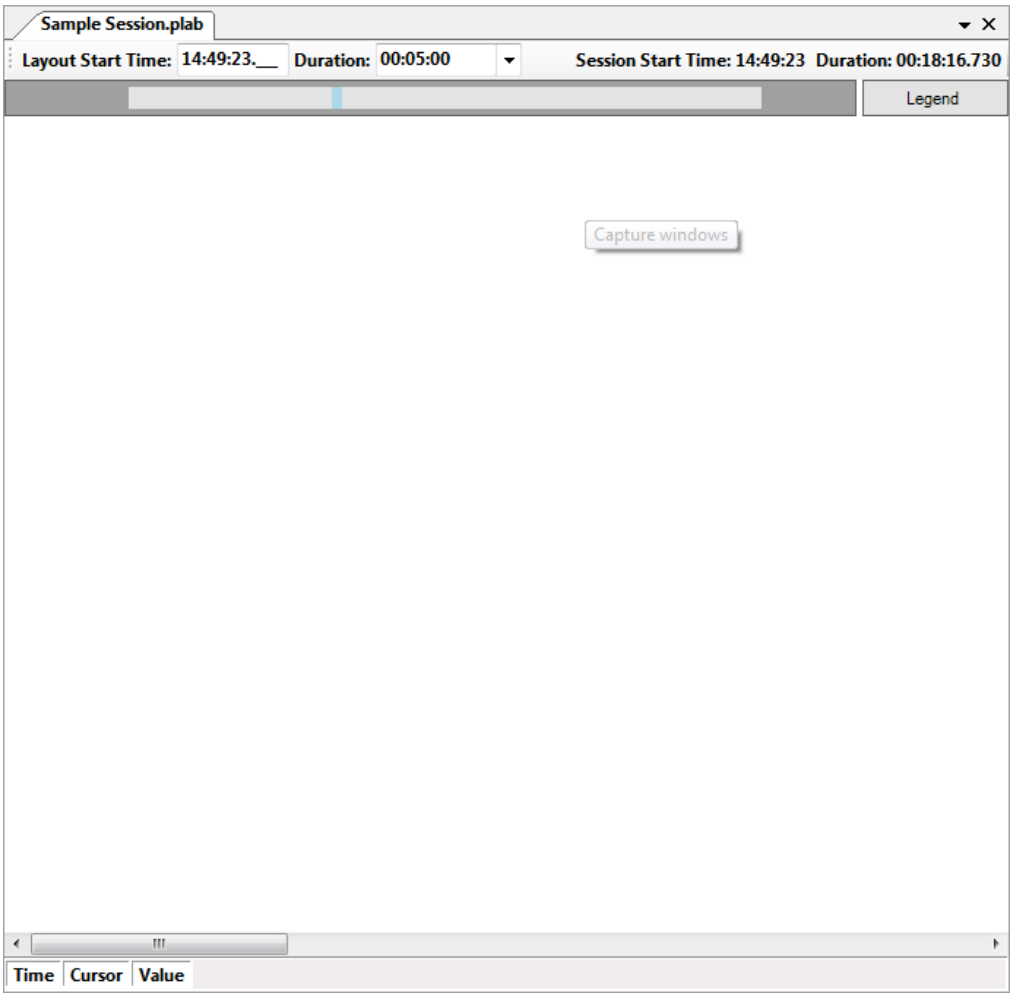

Figure 3: Synchronized Chart Panel (SCP)

Emptying the SCP

The first time VivoSense is opened, the SCP will be an empty slate. However, if you have been using VivoSense prior to this tutorial, it may contain plots of data. We will therefore begin by cleaning the SCP to its empty starting point. To do this, navigate to the bottom half of the data explorer as shown in Figure 4 and double click on the 'Empty' icon. This will empty the SCP or more correctly, load an empty layout to the SCP.

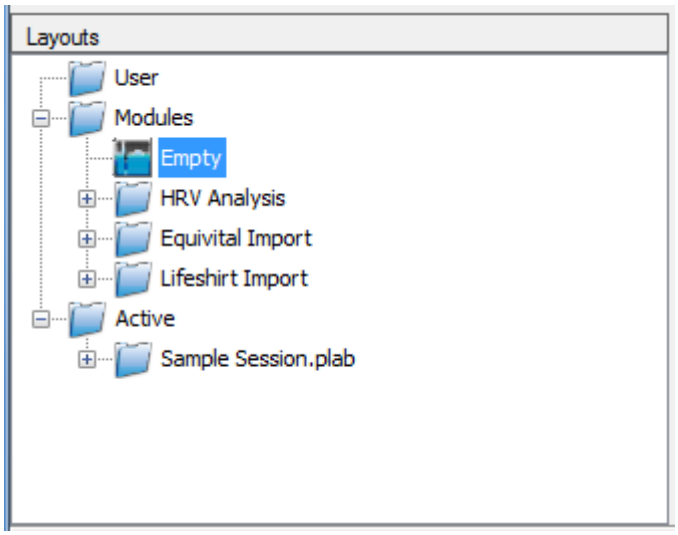

Figure 4: Layouts - Bottom Half of the Data Explorer

Displaying Data Channels

To display the data channel labeled Ecg1, select this with the mouse and drag it onto the empty SCP. Releasing the mouse will display a plot of this waveform on the first chart on the SCP, labeled 'Chart1'.

An alternative to dragging data channels onto the SCP for display is simply to double click on the data channel thus adding a new chart to the bottom of the existing charts on the SCP. Go ahead and try this by double clicking on Ecg2 to get two charts on the SCP, each with a single waveform plot, as shown in Figure 5.

Now remove Chart2 by right clicking on the chart and selecting Chart->Remove as shown in Figure 6.

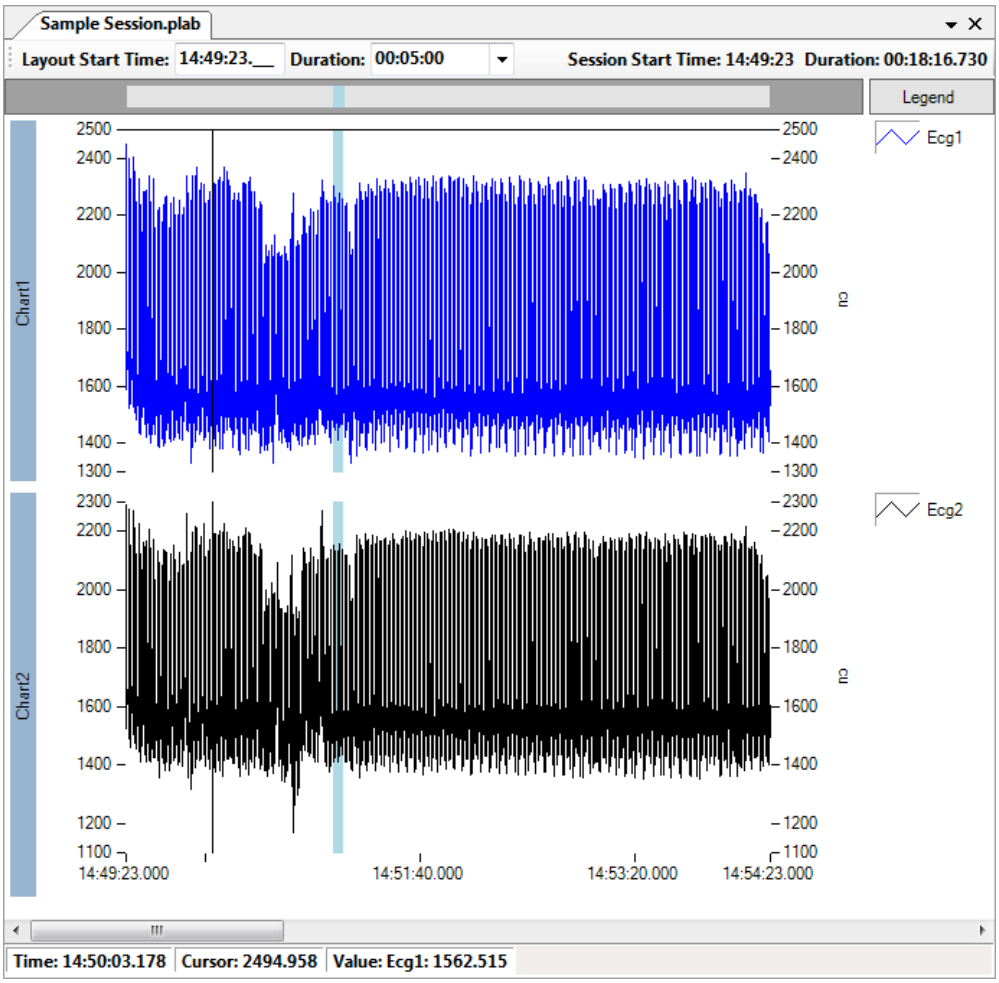

Figure 5: SCP with Two Charts Containing Plots of an Ecg Waveform

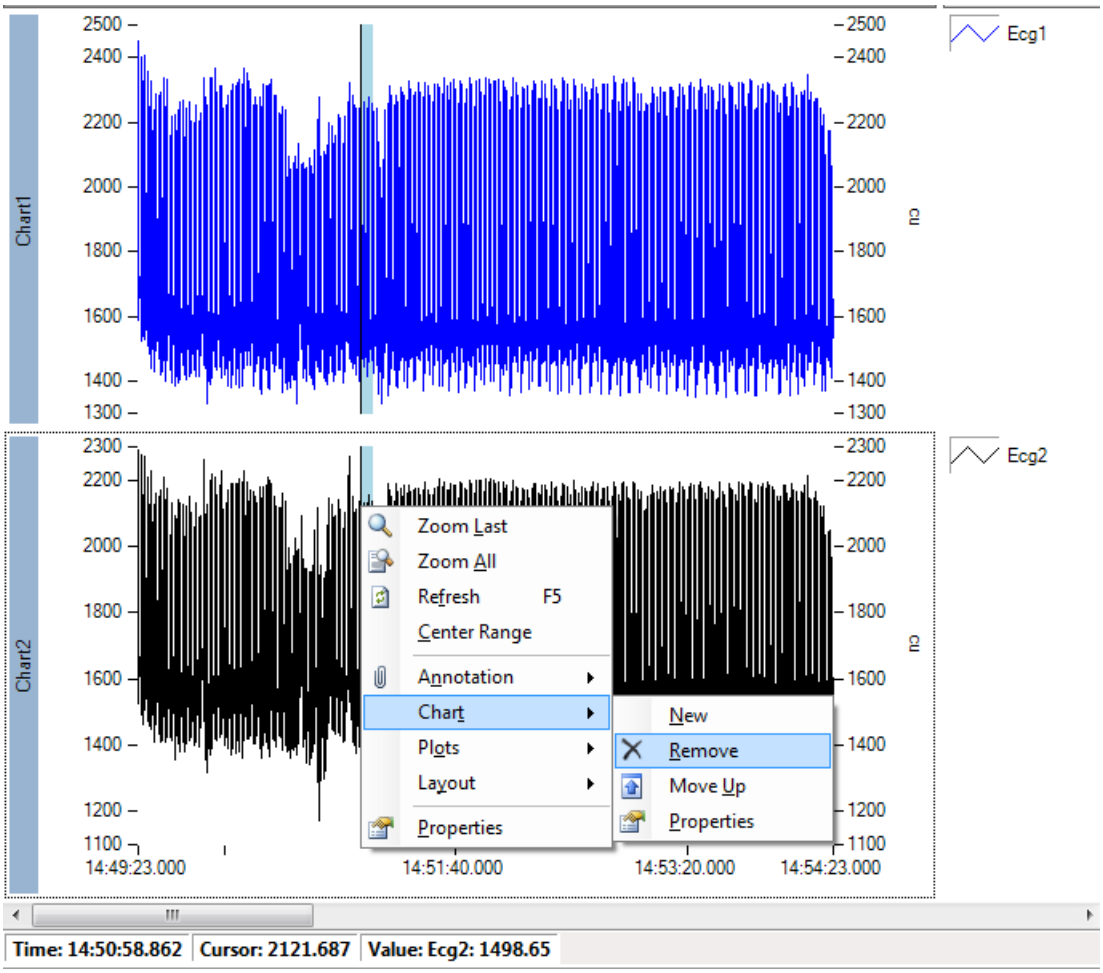

Figure 6: Removing a Chart

1.4. Visually Navigating VivoSense Data

Now we will explore the currently displayed Ecg1 waveform on the SCP.

Zoom

First we may want to zoom in or zoom out. The easiest way to zoom is to use the up and down arrow keys on your computer keyboard. Make sure that the SCP is selected with the cursor (click anywhere on the chart with the left mouse button) and press the down arrow key several times to zoom in.

An alternative to the arrow key short-cut is to select a desired region using the mouse. This is achieved by moving the cursor to the left edge of the desired region, pressing the left mouse button followed by moving the cursor to the right of the desired region and releasing the left mouse button. Next, select ‘Zoom Selection’ in the resulting pop-up context menu as displayed in Figure 7.

To display all the data, simply select ‘Zoom All’.

Go ahead and zoom in to the data so that only about six (6) Ecg R-wave spikes are displayed on the screen.

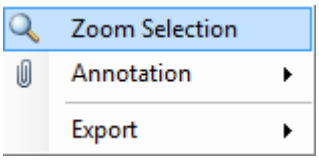

Figure 7: Zoom Context Menu

Scroll

To scroll through the data, the left and right arrow keys may be used. Alternatively the window slider bar at the bottom of the SCP may be used to navigate forward or backward in time.

1.5. VivoSense Algorithms

VivoSense contains many algorithms for deriving useful metrics or indices from basic physiological data. Frequently, but not always, the result of an algorithm is available as another data channel. These are sometimes referred to as 'derived channels' indicating that the channel is derived from another channel.

Our first example of an algorithm is the VivoSense QRS detection algorithm. This detects the location of an R-wave spike in an Ecg waveform. In VivoSense all the data processing is completed on-demand. This means that data is only calculated as needed for display or for export.

We can best demonstrate this with an example as follows:

Begin by navigating to the Electrocardiogram->Markings folder in the data explorer and highlighting Rwave1 then dragging this *onto the same chart as Ecg1* (Chart1). The result is displayed in Figure 8. Displaying this channel required the QRS detection algorithm to be run as indicated by the progress bar in the bottom right hand corner of the SCP status bar.

An additional channel which can be derived in this way is the heart rate (HR) channel. Add this to the SCP by browsing to Electrocardiogram->Measures in the data explorer and double clicking on the HR channel.

Please note that this channel is a measure and is denoted as such by the 'measures' icon .

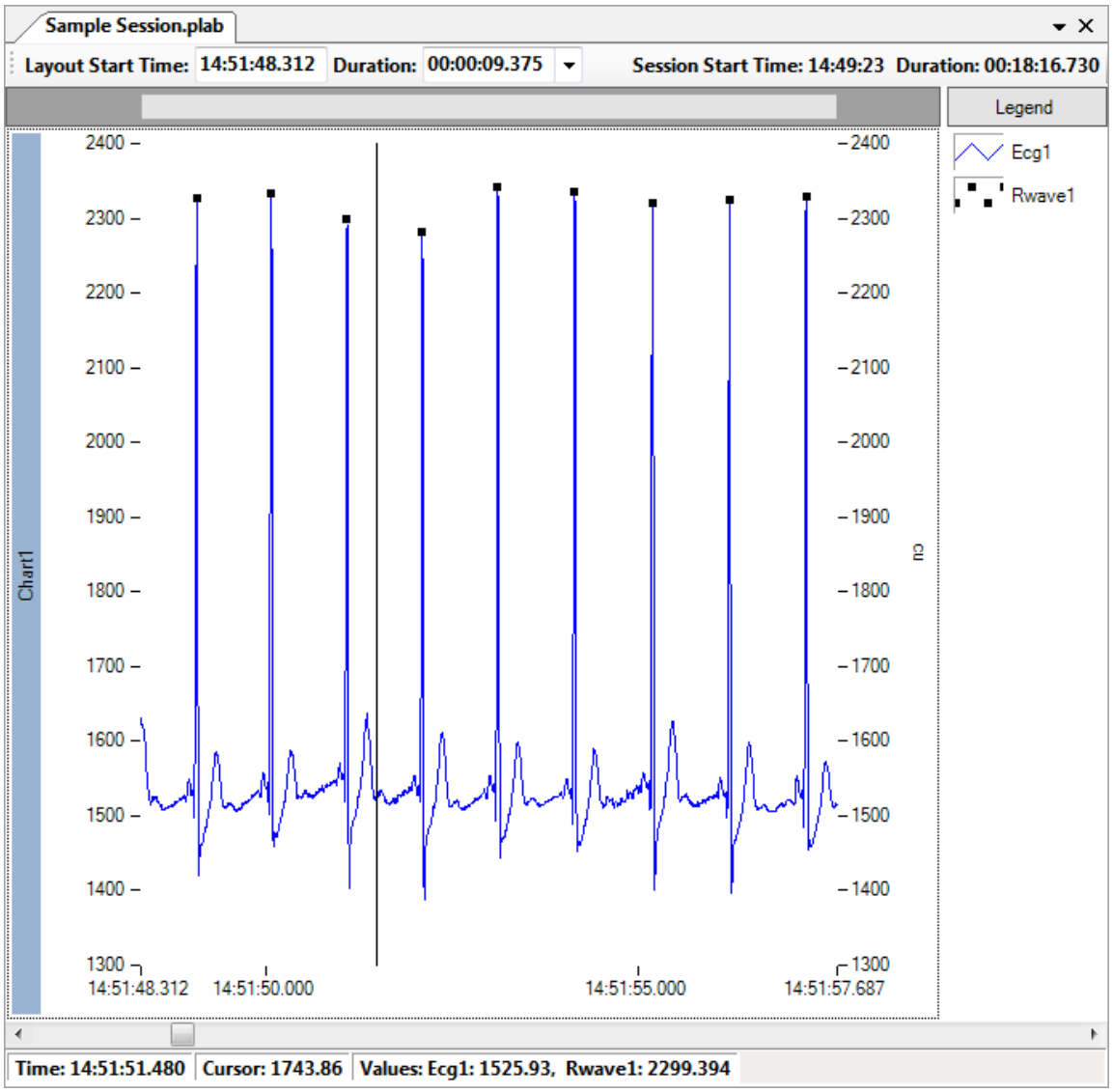

Figure 8: Displaying Derived R-wave Markings on the Same Chart as the Ecg Channel

1.6. Centering and Scaling Data

Centering Data

Once the HR channel is on the screen, zoom out several times using the up arrow key. You will notice that the plot goes out of range and it is easy to center the range by clicking anywhere on the chart and pressing the shortcut key ‘c’.

Scaling Data

It is also possible to edit the limits of the range by double-clicking on the top or bottom marking on the y-axes as shown in Figure 9. Once it is highlighted it is possible to edit this with any numerical value of your choice. Try this and then press the ‘c’ key again to center the range once you are done. Remember that you must click on the chart area in order for the shortcut to center will work.

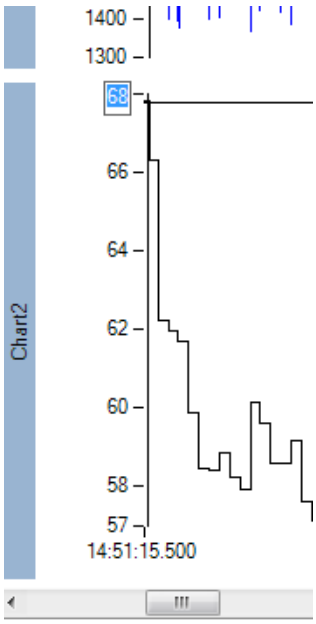

Figure 9: Editing the y-Axis Range

1.7. Measuring Data

The cursor may be used to measure data plotted in VivoSense. To complete this, place the cursor anywhere on Chart2 which contains the HR plot and note the values in the status bar as the cursor is moved as shown in Figure 10.

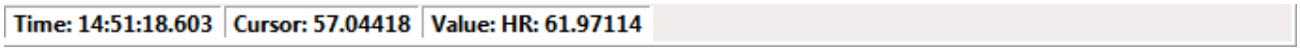

Figure 10: Status Bar Showing Cursor and Plot Values.

To measure a range, left click the mouse on the chart and hold the mouse button down while you drag a rectangular region between two points on the same chart. Note how the status bar now shows both the time difference (x-axis) and the cursor difference (y-axis).

Figure 11: Status Bar Showing a Measured Range.

1.8. Trends

VivoSense may be used to visualize and demonstrate trends in data. This is especially useful when visualizing lengthy data sets. Most derived measures may be trended and these trends may be displayed as VivoSense channels.

Begin by zooming to the full-file view. Remember this is achieved by right-clicking on a chart and selecting 'Zoom All'. Consider that you may want to re-center the HR channel after zooming out.

Browse the data explorer to the Electrocardiogram->Trends folder and select the 'Trend HR' channel. This is a trend channel and is denoted by the 'trend' icon .

Double click on this channel to display the HR trend. The resulting channel is a staircase waveform showing one minute median averages of the heart rate channel. In the next chapter we will learn how to change various trend properties such as the trend type and duration.

1.9. Layouts

Previously we introduced the concept of the 'Empty' layout to clear the SCP. We will now expand on this and show how custom layouts may be saved.

At this point there should be three charts displayed on the SCP. The first chart contains two plots: Ecg1 and Rwave1. The second chart contains one plot: HR. The third chart contains one plot: Trend HR.

If you wish to repeatedly organize and display plots of channels in this way simply save this as a layout. To do so, right click anywhere on the charts and navigate to Layout->Save as shown in Figure 12.

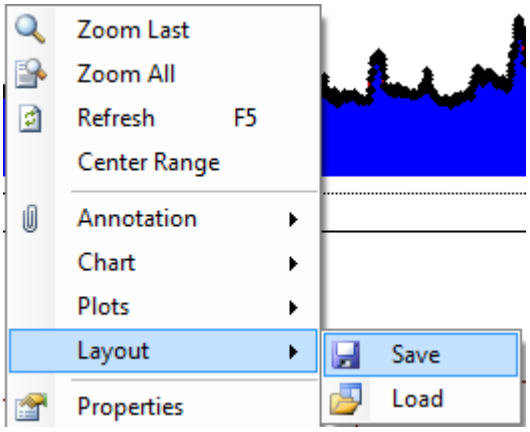

Figure 12: Saving Layouts

This will bring up a dialog to save a layout. Right click on the 'User' folder and select 'New Folder'. A new folder will appear. Right click on this and change the name of the new folder to Example. Then select Example and in the dialog type 'First Example' as shown in Figure 14. Once saved, note that it will appear in the bottom half of the data explorer as shown in Figure 15.

Please go ahead and test this.

Double click on the 'Empty' layout to clear the SCP.

Now double click on the ‘First Example’ layout to bring back the layout that was saved and continue where we left off.

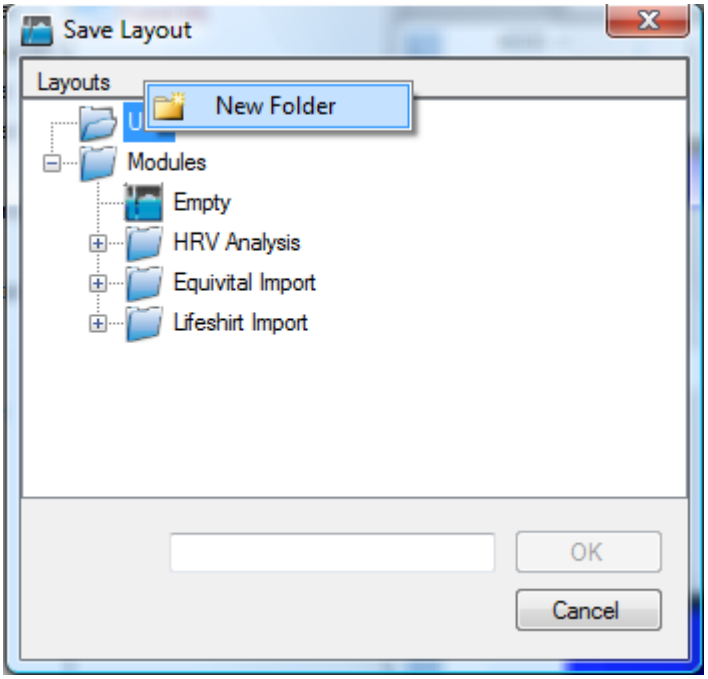

Figure 13: Creating a New Folder to Store a Layout

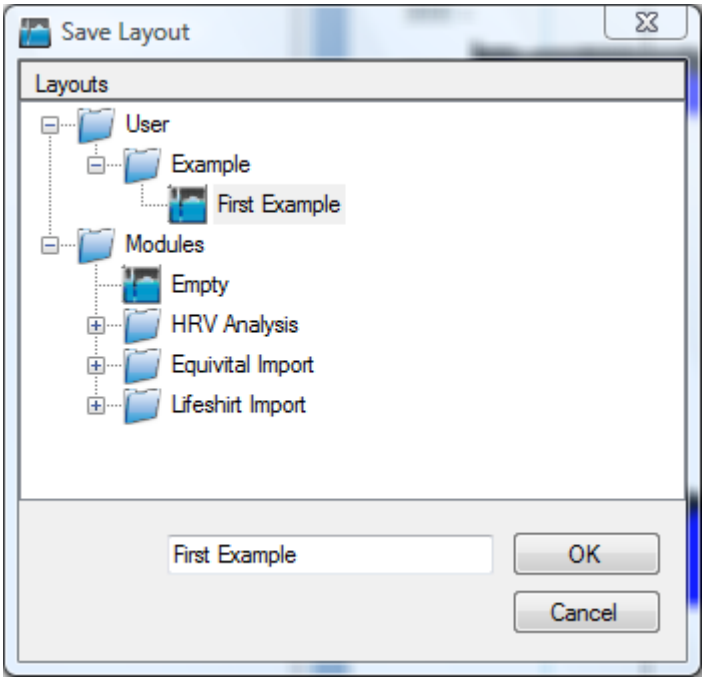

Figure 14:. First Example Layout

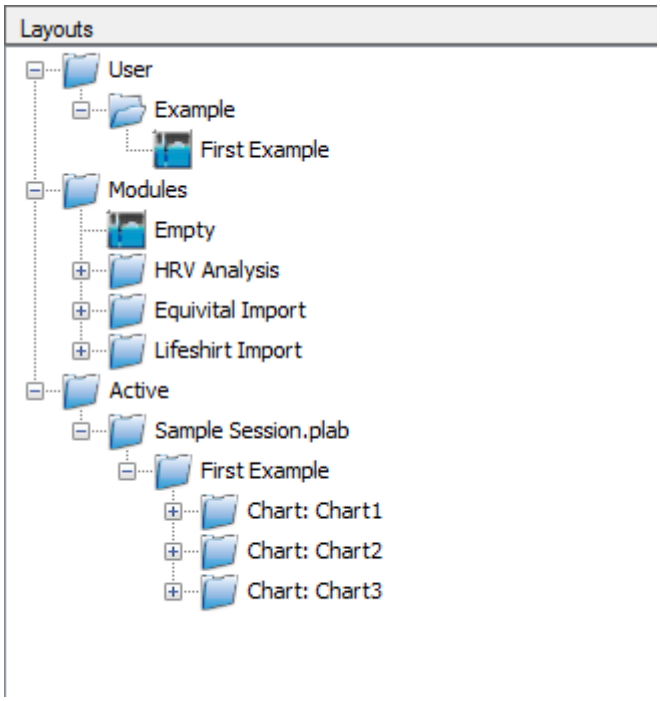

Figure 15: New Layout Appears in the Data Explorer

2. Properties Editor

Properties are an important concept in maximizing the utility of VivoSense. Every component in VivoSense has associated properties. Graphical building blocks in VivoSense such as plots, charts or data structures such as channel data or session information all have properties which can be inspected and, in some cases, modified by the user. Properties are a simple and intuitive way of navigating through VivoSense and will be illustrated with a few simple examples.

The Properties Editor window may be accessed from the toolbar by clicking on the 'cog' icon or using the short-cut key 'F4'. It is important to know that the Property Editor will always display the properties of the currently active component. Please note that the content of the Properties editor changes as you activate different components in VivoSense. This is demonstrated by clicking on them with the right mouse button.

2.1. Plot Properties

There are several ways to access Plot Properties in VivoSense. A convenient shortcut is also provided by simply clicking on the plot icon in the legend. Click on the HR icon to bring up a set of properties for the HR plot as shown in Figure 16.

Experiment by changing some of the plot properties. In this way we can demonstrate how it is possible to dramatically change the color and appearance of the plots. Try changing the properties so that the HR channel looks like the one in Figure 17. As you can see editing properties is quick and easy and the results are reflected by the application instantly, regardless of the type of property that is being edited.

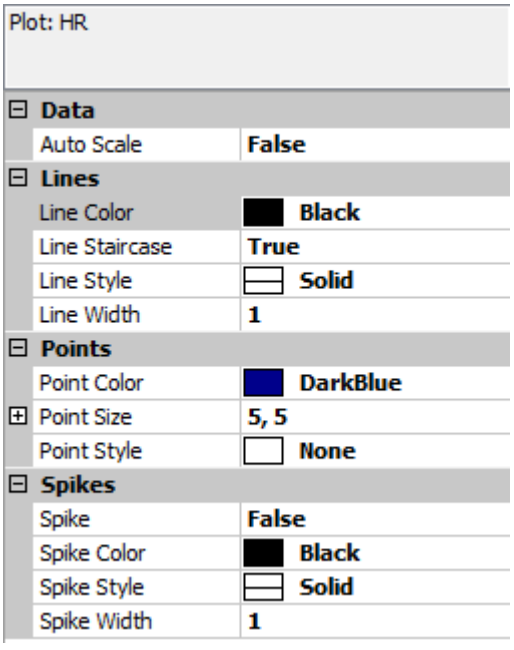

Figure 16: Plot Properties.

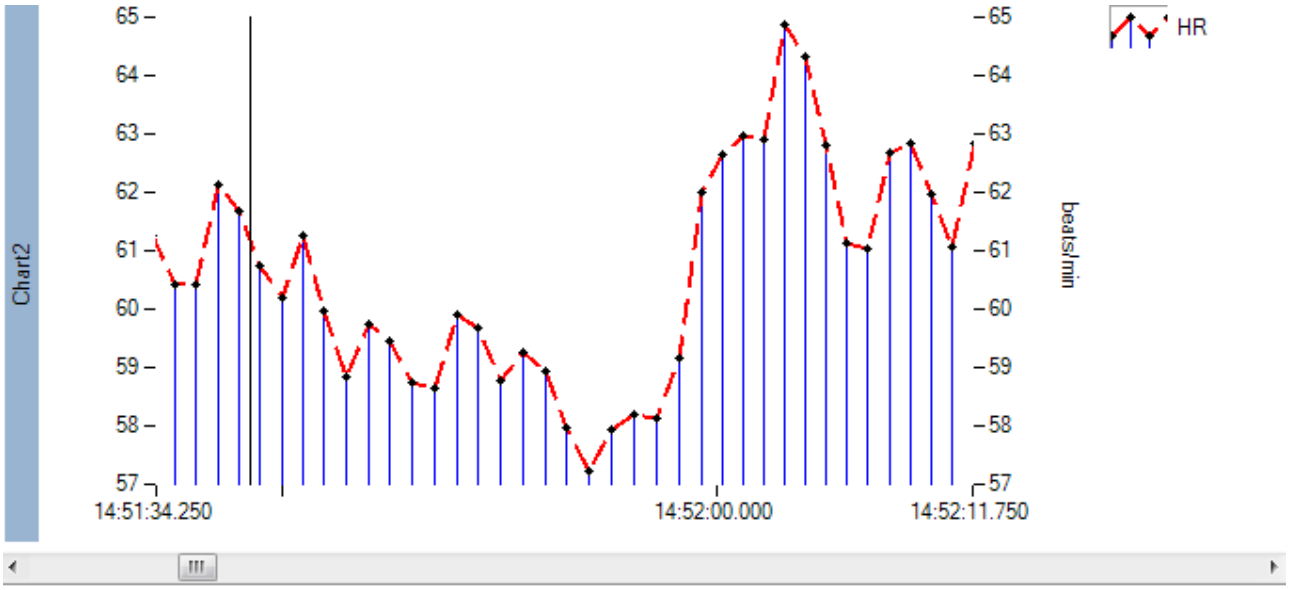

Figure 17: HR Plot with New Properties.

2.2. Channel Properties

Different channels have different properties. As we have discussed, derived channels may be created as the result of running an algorithm. The initial VivoSense parameter settings default to the values most appropriate for a given algorithm. In many instances the user may not want to change these parameters. Advanced VivoSense users may however find it desirable to adjust these settings. Any adjustable parameter is exposed as a channel property and may be modified using the Property Editor. This may be achieved by changing the channel properties.

The simplest example of an algorithm which may be displayed as a channel and where the user may wish to adjust the channel properties is in the trending capability of VivoSense (see Section 1.8).

There are several ways to access channel properties and a convenient shortcut is to again use the legend. This is the channel icon and label to the right of each chart. This time, instead of clicking on the plot icon, click on the channel text in the legend. For the purposes of this example, click on the text ‘Trend HR’. This will display the trend properties in the properties editor as shown in Figure 18.

Channel Settings	
Description	Trend of HR
Name	Trend HR
Path	Electrocardiogram\Trends\
Sample Rate (Hz)	0.0166666666666667
Trend Settings	
Mean Type	Temporal
Trend Overlap	**00:00:00**
Trend Type	**Median**
Trend Window Width	**00:01:00**

Figure 18: Trend Properties.

Properties displayed in grey may not be edited however properties shown in black may be edited by the VivoSense user.

The default trend type is a Median trend. Go ahead and click on the word ‘Median’ and note that a drop down arrow appears. Click on this to display a menu with different trends. Try changing the ‘Median’ to for example a ‘Mean’. This will immediately update the trend to generate a Mean calculation.

The trend window width shows 1 minute trends. Go ahead and change this property to 00:05:00 to display a 5 minute trends.

The trend overlap is available should you wish to calculate large trends but overlap them in time. Change the overlap property to 00:04:30 for a 4 minute and 30 second overlap. Note that you may quickly and easily calculate and display any type of trend.

Please note that you may plot trends as a separate chart or on top of an existing chart. Trend plot properties may also be easily changed.

3. Annotations

VivoSense allows the user to easily annotate data to mark specific events or area of particular interest.

3.1. Creating an Annotation

To create an Annotation begin by applying the 'Empty' layout to the SCP as shown in Figure 4. Following this, navigate the Data Explorer to Respiration->Waveforms->Volumes.

Double click on the Vt waveform to display a plot of this channel on the SCP. This channel represents the tidal volume respiratory waveform. Zoom all the way out and then zoom in twice using the down arrow key. This brings you to a region of potential interest. In this portion of the data we can see that the individual may be performing a breath-hold or may possibly be experiencing an apnea event. If this region of the data set is of potential interest then mark it with an annotation of your choice.

To create the annotation, left click the mouse at the start time of the event and hold it down. Drag the mouse until the end time of the event and then release the mouse. This creates a pop-up context menu where you should select Annotation->Add. This is shown in Figure 19.

Please ensure that your display matches Figure 19 by matching the layout start time and duration shown at the top of the figure.

Once the annotation is added, the result should match the one shown in Figure 20.

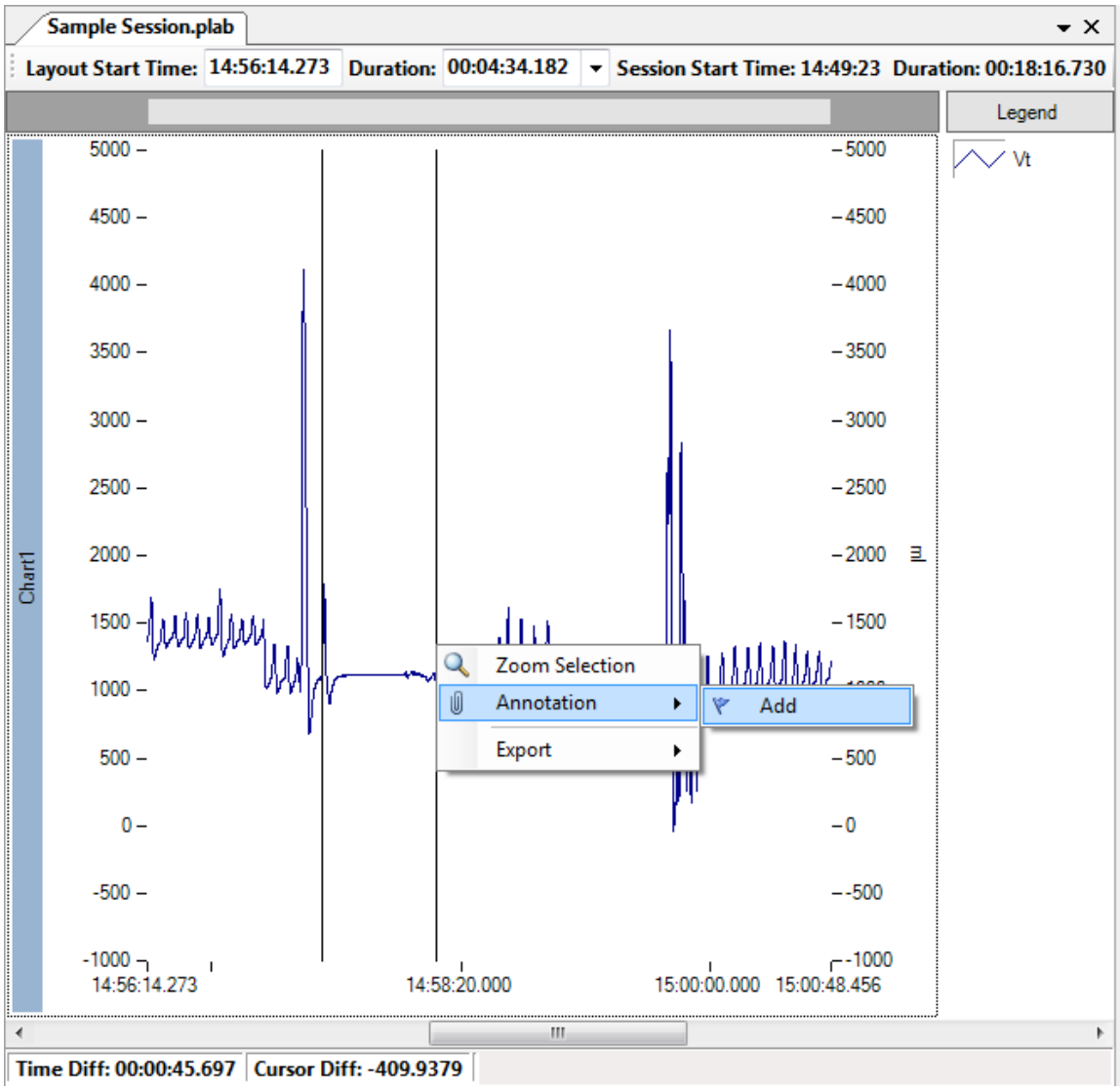

Figure 19: Adding an Annotation.

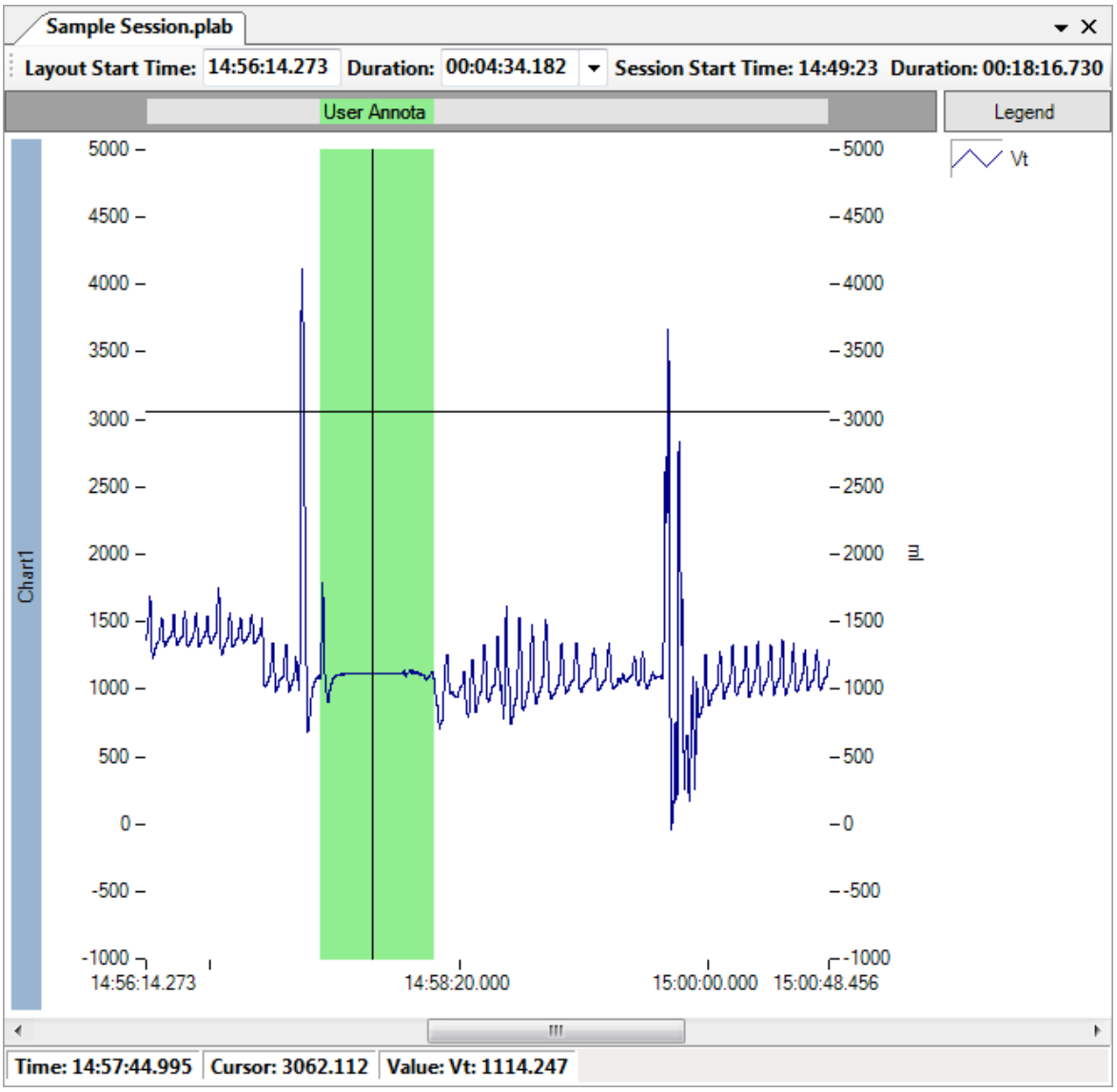

Figure 20: User Annotation Has Been Created.

3.2. Moving and Re-sizing Annotations

Once an annotation has been added, it is easy to move or resize the annotation. This is completed using the annotation bar. This is the bar at the top of the SCP that contains the text describing the annotation. The default text is simply ‘User Annotation’. This may be truncated depending on the size of the text and the current level of zoom.

Hover the mouse over the annotation in the annotation bar region. This is the small chart-like bar at the top of the SCP. The cursor will change to the ‘move’ cursor. Then left click on the bar and drag it to a new location.

To resize, hover the cursor at the edge of the annotation on the annotation bar until the ‘resize’ cursor appears. Then left click and hold down and stretch or shrink the annotation.

3.3. Annotation Manager and Properties

Click on the ‘notepad’ icon on the tool bar to open the annotation manager. This is displayed in Figure 21.

The annotation manager may be used to navigate between annotations. Select the green annotation and then look at the properties window to see the annotation properties. A this point changes to the text and color may be made to customize the annotation as desired. Any changes are then reflected in the annotation manager. Go ahead and explore some of these changes.

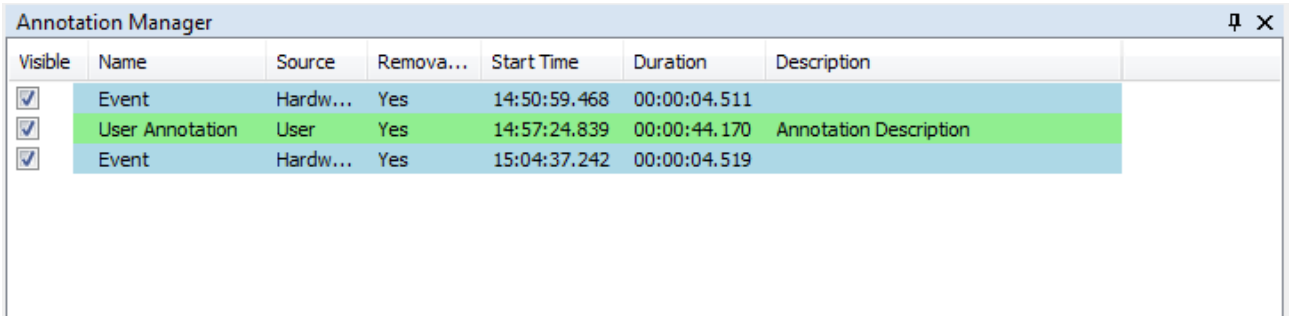

Figure 21: Annotation Manager.

4. Moving On

This tutorial is designed to get a user quickly started and familiar with VivoSense. There are of course many features that are beyond the scope of this tutorial and we suggest that the user consult the full manual for detailed descriptions of these features.

In general, many VivoSense features follow the basic principals illustrated in this short tutorial and the user is encouraged to experiment first, to report any bugs encountered, continue to learn and to enjoy using the VivoSense toolbox.